In the claims:

Amend claims 1-46 where indicated.

1. (Currently Amended) In a magnetic read head having an air bearing surface (ABS), a magnetic tunnel junction (MTJ) sensor for connection to sense circuitry for detecting changes in electrical resistance within the sensor, the sensor comprising:

a MTJ stack with an active region disposed at the ABS and having ~~two opposite~~ oppositely facing first and second sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:

an antiferromagnetic (AFM) layer spanning the active region,

a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,

a free layer of FM material spanning the active region and ~~extending beyond each of the two opposite sides thereof, and~~ having first and second free layer extensions which extend in opposite directions from the first and second sides respectively;

a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region; [[and]]

the AFM, pinned, free and tunnel junction layers having parallel surfaces which extend between the first and second sides and are orthogonal with respect to the ABS; and

the first and second free layer extensions having first and second top surfaces which are parallel with respect to the parallel surfaces of the AFM, pinned, free and tunnel junction layers;

[[a]] first and second longitudinal bias [[layer]] layers formed on and in contact with the ~~free layer~~ first and second top surfaces of the free layer extensions outside of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

2. (Currently Amended) The sensor of claim 1 further comprising:

an insulating layer of electrically nonconductive material formed on and in contact with the free layer extensions outside of the active region and in abutting contact with the ~~two opposite~~ first and second sides of the active region.

3. (Original) The sensor of claim 2 wherein the longitudinal bias layer is disposed without contacting the active region.

4. (Original) The sensor of claim 3 wherein the longitudinal bias layer comprises a hard magnetic (HM) material.

5. (Withdrawn) The sensor of claim 3 wherein the longitudinal bias layer comprises an AFM material.

6. (Original) The sensor of claim 1 wherein the longitudinal bias layer is disposed without contacting the active region.

A7 cont'd

7. (Original) The sensor of claim 6 wherein the longitudinal bias layer comprises a HM material.

8. (Withdrawn) The sensor of claim 6 wherein the longitudinal bias layer comprises an AFM material.

9. (Withdrawn) The sensor of claim 1 further comprising:

the longitudinal bias layer comprises an electrically nonconductive AFM material disposed outside of the active region and in abutting contact with the two opposite sides of the active region.

10. (Withdrawn) The sensor of claim 1 wherein the longitudinal bias layer comprises an electrically nonconductive HM material disposed outside of the active region and in abutting contact with the two opposite sides of the active region.

11. (Currently Amended) A direct access storage device (DASD) comprising:

a magnetic recording disk having at least one surface for storing magnetically recorded data;

a magnetic read head having an air bearing surface (ABS) disposed for reading the data from the magnetic recording disk surface;

in the magnetic read head, a magnetic tunnel junction (MTJ) sensor comprising:

a MTJ stack with an active region disposed at the ABS and having ~~two opposite~~ oppositely facing first and second sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:

an antiferromagnetic (AFM) layer spanning the active region,

a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,

a free layer of FM material spanning the active region and ~~extending beyond each of the two opposite sides thereof, and~~ having first and second free layer extensions which extend in opposite directions from the first and second sides respectively;

a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region; [[and]]

the AFM, pinned, free and tunnel junction layers having parallel surfaces which extend between the first and second sides and are orthogonal with respect to the ABS; and

the first and second free layer extensions having first and second top surfaces which are parallel with respect to the parallel surfaces of the AFM, pinned, free and tunnel junction layers;

[[a]] first and second longitudinal bias [[layer]] layers formed on and in contact with the ~~free layer~~ first and second top surfaces of the free layer extensions outside of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field;

an actuator for moving the magnetic read head across the magnetic recording disk surface to access the data stored thereon; and

a data channel having sense circuitry coupled electrically to the MTJ sensor for detecting changes in resistance of the MTJ sensor caused by rotation of the magnetic moment of the free ferromagnetic layer relative to the fixed magnetic moment of the pinned layer responsive to magnetic fields representing the data stored on the ~~magnet~~ magnetic recording disk surface.

A7 cont'd

12. (Currently Amended) The DASD of claim 11 further comprising:
an insulating layer of electrically nonconductive material formed on and in contact with the free layer outside of the active region and in abutting contact with the [[two]] first and second opposite sides of the active region.

13. (Original) The DASD of claim 12 wherein the longitudinal bias layer is disposed without contacting the active region.

14. (Original) The DASD of claim 13 wherein the longitudinal bias layer comprises a hard magnetic (HM) material.

A7 cont'd

15. (Withdrawn) The DASD of claim 13 wherein the longitudinal bias layer comprises an AFM material.

16. (Original) The DASD of claim 11 wherein the longitudinal bias layer is disposed without contacting the active region..

17. (Original) The DASD of claim 16 wherein the longitudinal bias layer comprises a HM material.

18. (Withdrawn) The DASD of claim 16 wherein the longitudinal bias layer comprises an AFM material.

19. (Withdrawn) The DASD of claim 11 further comprising:
the longitudinal bias layer comprises an electrically nonconductive AFM material disposed outside of the active region and in abutting contact with the two opposite sides of the active region.

20. (Withdrawn) The DASD of claim 11 wherein the longitudinal bias layer comprises an electrically nonconductive AFM material disposed outside of the active region and in abutting contact with the two opposite sides of the active region.

21. (Withdrawn) In a magnetic read head having an air bearing surface (ABS), a magnetic tunnel junction (MTJ) sensor for connection to sense circuitry for detecting changes in electrical resistance within the sensor, the sensor comprising:

a MTJ stack with an active region disposed at the ABS and having two opposite sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:

an antiferromagnetic (AFM) layer spanning the active region,

a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,

a free layer of FM material spanning the active region, and

a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region; and

a nonconductive longitudinal bias layer formed outside of the active region and in abutting contact with the two opposite sides of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

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22. (Withdrawn) The sensor of claim 21 wherein the nonconductive longitudinal bias layer comprises a hard magnetic (HM) material.

23. (Withdrawn) A direct access storage device (DASD) comprising:

a magnetic recording disk having at least one surface for storing magnetically recorded data;

a magnetic read head having an air bearing surface (ABS) disposed for reading the data from the magnetic recording disk surface;

in the magnetic read head, a magnetic tunnel junction (MTJ) sensor comprising:

a MTJ stack with an active region disposed at the ABS and having two opposite sides each disposed generally orthogonally to the ABS, the MTJ stack comprising:

an antiferromagnetic (AFM) layer spanning the active region,

a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,

a free layer of FM material spanning the active region, and

a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer in the active region; and

a nonconductive longitudinal bias layer formed outside of the active region and in abutting contact with the two opposite sides of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field;

an actuator for moving the magnetic read head across the magnetic recording disk surface to access the data stored thereon; and

a data channel having sense circuitry coupled electrically to the MTJ sensor for detecting changes in resistance of the MTJ sensor caused by rotation of the magnetic moment of the free ferromagnetic layer relative to the fixed magnetic moment of the pinned layer responsive to magnetic fields representing the data stored on the magnetic recording disk surface.

24. (Withdrawn) The sensor of claim 23 wherein the nonconductive longitudinal bias layer comprises a hard magnetic (HM) material.

25. (Withdrawn) A method for fabricating a magnetic tunnel junction (MTJ) sensor for use in a magnetic read head having an air bearing surface (ABS), the method comprising the unordered steps of:

A7 cont'd

(a) forming a MTJ stack with an active region disposed at the ABS and having two opposite sides each disposed generally orthogonally to the ABS, including the unordered steps of:

(a.1) forming an antiferromagnetic (AFM) layer,

(a.2) forming a pinned layer of ferromagnetic (FM) material in contact with the AFM layer,

(a.3) forming a free layer of FM material,

(a.4) forming a tunnel junction layer of electrically nonconductive material disposed between the pinned layer and the free layer, and

(a.5) removing all material outside of the active region from the AFM layer, the pinned layer, and the tunnel junction layer to define the two opposite sides of the active region; and

(b) forming a longitudinal bias layer outside of the active region in contact with the free layer for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

26. (Withdrawn) The method of claim 25 further comprising the step of:

(c) forming an insulating layer of electrically nonconductive material on and in contact with the free layer outside of the active region and in abutting contact with the two opposite sides of the active region.

27. (Withdrawn) The method of claim 26 wherein the longitudinal bias layer is disposed without contacting the active region.

28. (Withdrawn) The method of claim 27 wherein the longitudinal bias layer comprises a hard magnetic (HM) material.

29. (Withdrawn) The method of claim 27 wherein the longitudinal bias layer comprises an AFM material.

30. (Withdrawn) The method of claim 25 wherein the longitudinal bias layer is disposed without contacting the active region.

31. (Withdrawn) The method of claim 30 wherein the longitudinal bias layer comprises a HM material.

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32. (Withdrawn) The method of claim 30 wherein the longitudinal bias layer comprises an AFM material.

33. (Withdrawn) The method of claim 25 wherein the forming step (b) further comprises the step of:

(b.1) forming a nonconductive longitudinal bias layer outside of the active region and in abutting contact with the two opposite sides of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

34. (Withdrawn) The sensor of claim 33 wherein the nonconductive longitudinal bias layer comprises a HM material.

35. (Withdrawn) The sensor of claim 33 wherein the nonconductive longitudinal bias layer comprises an AFM material.

36. (Withdrawn) The method of claim 25 wherein the removing step (a.5) further comprises the step of:

(a.5.1) removing all material outside of the active region from the AFM layer, the pinned layer, the tunnel junction layer and the free layer to define the two opposite sides of the active region.

37. (Withdrawn) The method of claim 36 wherein the forming step (b) further comprises the step of:

(b.1) depositing additional FM material on the free layer in the active region and beyond the two opposite sides of the active region.

38. (Withdrawn) The method of claim 37 further comprising the step of:

(c) forming an insulating layer of electrically nonconductive material on and in contact with the free layer outside of the active region and in abutting contact with the two opposite sides of the active region.

39. (Withdrawn) The method of claim 38 wherein the longitudinal bias layer is disposed without contacting the active region.

40. (Withdrawn) The method of claim 39 wherein the longitudinal bias layer comprises a hard magnetic (HM) material.

A7 cont'd

41. (Withdrawn) The method of claim 39 wherein the longitudinal bias layer comprises an AFM material.

42. (Withdrawn) The method of claim 37 wherein the longitudinal bias layer is disposed without contacting the active region.

43. (Withdrawn) The method of claim 42 wherein the longitudinal bias layer comprises a HM material.

44. (Withdrawn) The method of claim 42 wherein the longitudinal bias layer comprises an AFM material.

45. (Withdrawn) The method of claim 36 wherein the forming step (b) further comprises the step of:

(b.1) forming a nonconductive longitudinal bias layer outside of the active region and in abutting contact with the two opposite sides of the active region for biasing the magnetic moment of the free layer in substantially a predetermined direction in the absence of an external magnetic field.

46. (Withdrawn) The method of claim 45 wherein the nonconductive longitudinal bias layer comprises a hard magnetic (HM) material.

Add new claims 47-52.

47. (New) A magnetic tunnel junction sensor, which has an air bearing surface (ABS), comprising:

a ferromagnetic pinned layer having a magnetic moment;

an antiferromagnetic (AFM) pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer perpendicular to the ABS;

a ferromagnetic free layer having a magnetic moment parallel to the ABS;

a nonconductive and nonmagnetic spacer layer located between the free and pinned layers;

each of the AFM, pinned, spacer and free layers having first and second side surfaces which are orthogonal with respect to the ABS with the first side surfaces of the AFM, pinned spacer and free layers being contiguous and the second side surfaces of the AFM, pinned, spacer and free layers being contiguous;

each of the AFM, pinned, spacer and free layers having major thin film surfaces which extend between the first and second side surfaces, are orthogonal with respect to the ABS and are parallel with respect to one another;

the free layer having laterally extending first and second side extensions which extend in opposite directions from the first and second side surfaces respectively of the free layer with each of the first and second side extensions having a top surface which is orthogonal with respect to the ABS and parallel with respect to said major thin film surfaces;

first and second longitudinal bias layers interfacing the top surfaces of the first and second side extensions and spaced from the first and second side surfaces respectively of the free layer so as to leave first and second top surface portions respectively between the first and second longitudinal bias layers and the first and second side surfaces respectively of the free layer which are not interfaced by the first and second longitudinal bias layers; and

nonconductive and nonmagnetic first and second insulation layers interfacing the first and second side surfaces respectively of the AFM, pinned, spacer and free layers, the first and second top surface portions respectively and the first and second longitudinal bias layers respectively.

48. (New) The sensor as claimed in claim 47 wherein the first and second longitudinal bias layers are composed of a hard magnetic material.

49. (New) A magnetic read head, which has an air bearing surface (ABS), comprising:

first and second lead layers;

a magnetic tunnel junction (MTJ) sensor located between and in electrical contact with the first and second lead layers;

the MTJ sensor comprising:

a ferromagnetic pinned layer having a magnetic moment;

an antiferromagnetic (AFM) pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer perpendicular to the ABS;

a ferromagnetic free layer having a magnetic moment parallel to the ABS;

a nonconductive and nonmagnetic spacer layer located between the free and pinned layers;

each of the AFM, pinned, spacer and free layers having first and second side surfaces which are orthogonal with respect to the ABS with the first side surfaces of the AFM, pinned spacer and free layers being contiguous and the second side surfaces of the AFM, pinned, spacer and free layers being contiguous; and

each of the AFM, pinned, spacer and free layers having major thin film surfaces which extend between the first and second side surfaces, are orthogonal with respect to the ABS and are parallel with respect to one another;

first and second longitudinal bias layers interfacing the top surfaces of the first and second side extensions and spaced from the first and second side surfaces respectively of the free layer so as to leave first and second top surface portions respectively between the first and second longitudinal bias layers and the first and second side surfaces respectively of the free layer which are not interfaced by the first and second longitudinal bias layers; and

nonconductive and nonmagnetic first and second insulation layers interfacing the first and second side surfaces respectively of the AFM, pinned, spacer and free layers, the first and second top surface portions respectively and the first and second longitudinal bias layers respectively.

50. (New) The magnetic head as claimed in claim 49 wherein the first and second longitudinal bias layers are composed of a hard magnetic material.

51. (New) A direct access storage device (DASD) comprising:

a magnetic recording disk having at least one surface for storing magnetically recorded data;

a magnetic read head having an air bearing surface (ABS) disposed for reading the data from the magnetic recording disk surface;

in the magnetic read head, a magnetic tunnel junction (MTJ) sensor comprising:

a ferromagnetic pinned layer having a magnetic moment;

an antiferromagnetic (AFM) pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer perpendicular to the ABS;

a ferromagnetic free layer having a magnetic moment parallel to the ABS;

a nonconductive and nonmagnetic spacer layer located between the free and pinned layers;

A7 cont'd

each of the AFM, pinned, spacer and free layers having first and second side surfaces which are orthogonal with respect to the ABS with the first side surfaces of the AFM, pinned spacer and free layers being contiguous and the second side surfaces of the AFM, pinned, spacer and free layers being contiguous;

each of the AFM, pinned, spacer and free layers having major thin film surfaces which extend between the first and second side surfaces, are orthogonal with respect to the ABS and are parallel with respect to one another; and

the free layer having laterally extending first and second side extensions which extend in opposite directions from the first and second side surfaces respectively of the free layer with each of the first and second side extensions having a top surface which is orthogonal with respect to the ABS and parallel with respect to said major thin film surfaces;

first and second longitudinal bias layers interfacing the top surfaces of the first and second side extensions and spaced from the first and second side surfaces respectively of the free layer so as to leave first and second top surface portions respectively between the first and second longitudinal bias layers and the first and second side surfaces respectively of the free layer which are not interfaced by the first and second longitudinal bias layers;

nonconductive and nonmagnetic first and second insulation layers interfacing the first and second side surfaces respectively of the AFM, pinned, spacer and free layers, the first and second top surface portions respectively and the first and second longitudinal bias layers respectively;

an actuator for moving the magnetic read head across the magnetic recording disk surface to access the data stored thereon; and

a data channel having sense circuitry coupled electrically to the MTJ sensor for detecting changes in resistance of the MTJ sensor caused by rotation of the magnetic moment of the free ferromagnetic layer relative to the fixed magnetic moment of the pinned layer responsive to magnetic fields representing the data stored on the magnet recording disk surface.

A7 cont.

52. (New) The sensor as claimed in claim 51 wherein the first and second longitudinal bias layers are composed of a hard magnetic material.